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PATENT
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

NORIO SHIMOZONO et al.

Application No.: 10/646,036

Filed: August 22, 2003

For: NETWORK SYSTEM AND ITS SWITCHES

Customer No.: 20350

Examiner: Unassigned

Technology Center/Art Unit: 2661

Confirmation No.: 9277

PETITION TO MAKE SPECIAL FOR NEW APPLICATION UNDER M.P.E.P. § 708.02, VIII & 37 C.F.R. § 1.102(d)

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This is a petition to make special the above-identified application under MPEP § 708.02, VIII & 37 C.F.R. § 1.102(d). The application has not received any examination by an Examiner.

(a) The Commissioner is authorized to charge the petition fee of $130 under 37 C.F.R. § 1.17(i) and any other fees associated with this paper to Deposit Account 20-1430.

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(b) All the claims are believed to be directed to a single invention. If the Office determines that all the claims presented are not obviously directed to a single invention, then Applicants will make an election without traverse as a prerequisite to the grant of special status.

(c) Pre-examination searches were made of U.S. issued patents, including a classification search and a computer database search. The searches were performed on or around July 12, 2004, and were conducted by a professional search firm, Kramer & Amado, P.C. The classification search covered Class 707 (subclasses 10 and 204), Class 709 (subclasses 203, 217, 223, and 226), and Class 711 (subclasses 111, 113, 114, 154, 156, 161, and 162). The computer database search was conducted on the USPTO systems EAST and WEST. The inventors further provided a reference considered most closely related to the subject matter of the present application (see reference #6 below), which was cited in the Information Disclosure Statement filed with the application on August 22, 2003.

(d) The following references, copies of which are attached herewith, are deemed most closely related to the subject matter encompassed by the claims:

(1) U.S. Patent No. 6,477,618 B2;
(2) U.S. Patent Publication No. 2002/0124134 A1;
(3) U.S. Patent No. 6,701,411 B2;
(4) U.S. Patent Publication No. 2002/0144058 A1;
(5) U.S. Patent Publication No. 2004/0088297 A1;
(6) Japanese Patent Publication No. 2002-132455.

(e) Set forth below is a detailed discussion of references which points out with particularity how the claimed subject matter is distinguishable over the references.

A. Claimed Embodiments of the Present Invention

The claimed embodiments relate to a network system configured to speed up access to data without changing settings of a computer in a storage area network so that network bandwidth can be saved. The present approach is superior to the conventional network cache technology, which requires a metadata server to access data and that the

settings and operation of the computer be changed. More specifically, a protocol used for accessing data (e.g., the SCSI protocol conventionally used in SAN) needs to be changed to a dedicated protocol that uses the metadata server. If the network cache technology for handling data on a file basis is used, it is difficult to speed up a response because processing for judging a cache hit is complicated. See specification at page 3, line 3-14.

Independent claim 1 recites a network system comprising a computer, a switch that is connected to the computer via a network, a first storage device that is connected to the switch via the network, and a second storage device that is connected to the switch via the network. The switch transfers data stored in the first storage device to the second storage device. The computer issues a read request for the data stored in the first storage device. When receiving the read request, the switch converts the read request for the data stored in the first storage device into a data read request to the second storage device, and then transmits the converted data read request to the second storage device. When receiving the data read request, the second storage device transfers data corresponding to the received data read request to the switch. When receiving the data, the switch transfers the received data to the computer as data transferred from the first storage device.

Independent claim 4 recites a network system comprising a computer, a switch that is connected to the computer via a network, a first storage device that is connected to the switch via the network; and a second storage device that is connected to the switch via the network. The switch transfers data stored in the first storage device to the second storage device. The switch provides the computer with a third storage device corresponding to the first storage device, the third storage device being a virtual storage, and the computer issues a data read request to the third storage device. When receiving the data read request, the switch converts the data read request to the third storage device into a data read request to the second storage device, and then transmits the converted data read request to the second storage device. When receiving the data read request, the second storage device transfers, to the switch, data corresponding to the received data read request, and when receiving the data, the switch transfers the received data to the computer as data transferred from the third storage device.

Independent claim 6 recites a network system comprising a computer, a first storage device that is connected to the computer via a network, and a second storage device

that is connected to the computer via the network. The second storage device comprises a switch unit that is connected to the computer and the first storage device via the network, and a storage unit that is connected to the switch unit via an internal network. The switch unit beforehand transfers data stored in the first storage device to the storage unit, and the computer issues a read request for the data stored in the first storage device. When receiving the read request, the switch unit converts the read request for the data stored in the first storage device into a data read request to the storage unit, and then transmits the converted data read request to the storage unit. When receiving the data read request, the storage unit transfers, to the switch unit, data corresponding to the received data read request, and when receiving the data, the switch unit transfers the received data to the computer as data transferred from the first storage device.

Independent claim 7 recites a network system comprising a computer, a switch that is connected to the computer via a network, a first storage device that is connected to the switch via the network, and a second storage device that is connected to the switch via the network. The computer issues a read request for the data stored in the first storage device, and the switch receives the read request. If the data stored in the first storage device is stored in the second storage device, the switch converts the read request for the data stored in the first storage device into a data read request to the second storage device, and then transmits the converted data read request to the second storage device, whereas if the data stored in the first storage device is not stored in the second storage device, the switch transmits the read request to the first storage device without converting the read request for the data. When receiving the data read request, the second storage device transfers, to the switch, data corresponding to the received data read request, and when receiving the data, the switch transfers the received data to the computer as data transferred from the first storage device.

Independent claim 11 recites a switch that is connected to a computer, a first storage device, and a second storage device. The switch is comprised of a port unit that is connected to an external device, a converter for converting commands and data which have been received by the port unit, and a switch unit for relaying the command and the data according to address information. The converter beforehand transfers data stored in the first storage device to the second storage device, and when receiving from the computer an access request for the data stored in the first storage device, the converter converts the access request

into an access request to the second storage device. The switch unit transmits to the second storage device through the port unit the access request to the second storage device. When receiving data corresponding to the access request from the second storage device, the converter converts the data into data transmitted from the first storage device, and then transfers the converted data to the computer.

One of the benefits that may be derived is that it is possible to speed up an access to data held in a storage device connected to a SAN. Because the amount of data flowing through a SAN can be reduced, a load on the SAN can be reduced.

B. Discussion of the References

None of the following references disclose or suggest a switch that beforehand transfers data stored in a first storage device to a second storage device; and, when a read request for the original data is issued by a computer, converts the read request for the data stored in the first storage device into a data read request to the second storage device; transfers the copied data in the second storage device to the computer as data transferred from the first storage device. Nor do the references disclose a switch that transfers copied data from the second storage device as data transferred from a virtual storage device. The references also fail to teach a switch unit that beforehand transfers data stored in the first storage device to a storage unit connected to the switch unit via an internal network. Moreover, the references do not disclose a switch having a converter for converting commands and data which have been received by a port unit, wherein when receiving data corresponding to an access request from the second storage device, the converter converts the data transmitted from the first storage device, and then transfers the data to the computer.

1. U.S. Patent No. 6,477,618 B2

This reference discloses a storage subsystem comprising integrated cached disk arrays (ICDAs) 14' connected to a cluster interconnect 32. A number of hosts 10 and/or SANs have respective interfaces to the storage cluster 30, which includes the ICDAs 14' and cluster interconnect 32. The hosts 10 and/or SANs are connected to front-end director modules (F) 20', and the internal disks are connected to back-end director modules (B) 22'. The director modules 20' and 22' are connected to a switch network 34, which also has connections to a memory 24'. The switch network 34 also connects to the cluster

interconnect 32. The switch network 34 is responsible for establishing connections among the participants in data transfers. When a front-end director 20' receives a request from a host 10, for example, it determines what the target of the request is, i.e., the memory 24', a back-end director 22', or the cluster interconnect 32, and directs the switch network 34 to establish the desired connection. See column 5, line 17 to column 6, line 43.

2. U.S. Patent Publication No. 2002/0124134 A1

This reference contains essentially the same disclosure as item #1.

3. U.S. Patent No. 6,701,411 B2

This reference discloses a disk storage system configured to send an access request from a host to a storage subsystem. The disk storage system contains a storage device having a recording medium for holding the data, a plurality of storage subsystems having a controller for controlling the storage device, a first interface node coupled to a computer using the data stored in the plurality of storage subsystems, a plurality of second interface nodes connected to any or one of the storage subsystems, and a switch connecting between the first interface node and the plurality of second interface nodes to perform frame transfer therebetween based on node address information added to the frame. The first interface node preferably has a configuration table to store structural information for the memory storage system and a processing unit to analyze the applicable frame in response to the frame sent from the computer, converts information relating to the transfer destination of that frame based on structural information held in the configuration table, and transfers that frame to the switch. When transmitting a frame, the first interface node adds the node address information about the node that must receive the frame, to that frame. A second interface node then removes the node address information from the frame that was received, recreates the frame, and transfers that frame to the desired storage subsystem. When for instance the host #2 is accessing the region A1001, an access request is made specifying the region A1001, and this access request is converted by the diskarray switch 20 into a request for accessing the region A1101 of the LU of the diskarray subset #0 and this request is then sent to the diskarray subset #0. See column 2, lines 23-59; and column 6, lines 29-56.

4. U.S. Patent Publication No. 2002/0144058 A1

This reference discloses a network-based disk redundancy storage system and method receiving a file replication request. In response to a file creation request that is associated with an external input of one distributed data storage unit, the object management system preferentially creates a data file in that distributed data storage unit. In response to a file retrieval request that is associated with a data file and an external output of a distributed data storage unit, the object management system preferentially returns a hostname and pathname of a copy of the data file that is stored within that distributed data storage unit. The object management system also makes redundant copies of data files in different units to provide high availability of data. A flow diagram 500 illustrates the operations of the data storage system 100 when committing a file to redundant storage. When the application is ready to commit the file to redundant storage, the application makes a replication request to the OMS 240. The replication request includes the source hostname, the name of the file to be replicated, and the name of the replicated file. Fig. 6 is a flow diagram 600 illustrating the operations of the data storage system 100 when an application is retrieving a file. Assuming that multiple copies of the file are stored in the data storage system 100, the OMS 240 will preferentially select a copy that is stored within the data storage unit with the most idle capacity. The OMS 240 then returns the hostname and pathname of the file to the application. See [0064]-[0069].

5. U.S. Patent Publication No. 2004/0088297 A1

This reference discloses a distributed network attached storage system that transmits a request over the network for a file identified in the file system. A load-balancing switch selects one of the storage nodes to process the request. The storage nodes are coupled to a storage area network 410. Each node (server) has access to each disk in the storage area network 410. For example, if volume manager 170 determines that data resides on disk 420, then volume manager 170 accesses disk 420 over storage area network 420 in accordance with the protocol for the storage area network 420. If storage area network 410 implements a TCP/IP protocol, then volume manager 170 generates packet requests to disk 420 using the IP address assigned to disk 420. Index nodes, referred to as "inodes" uniquely identify files and directories. Inodes map files and directories of a file system to physical locations. Each inode is identified by a number. For a directory, an inode includes a list of file names and

sub directories, if any, as well as a list of data blocks that constitute the file or subdirectory. The inode also contains size, position, etc. of the file or directory. When a selected node (NAS server) receives a request from the client to service a particular inode, the selected node performs a lookup to obtain the physical location of the corresponding file or directory in the physical media. See [0025]-[0027].

6. Japanese Patent Publication No. 2002-132455

This reference discloses a cache manager and a computer system. A storage device is connected to an SAN and has no cache function. The cache manager 1200 provides the storage device 1060 which has no cache function with the cache function. A computer 1010 issues an input/output request for accessing the data stored in the storage device 1060 to the cache manager 1200. The cache manager 1200 converts the positional information on the data received together with the input/output request into the address of the target storage device 1060 an d its data positional information, and provides the storage device 1060 with the cache function. Although it is possible to install a cache device in the SAN, a metadata server is required to access data, and the settings and operation of the computer need to be changed. More specifically, a protocol used for accessing data (e.g., the SCSI protocol conventionally used in SAN), needs to be changed to a dedicated protocol that uses the metadata server.

(f) In view of this petition, the Examiner is respectfully requested to issue a first Office Action at an early date.

Respectfully submitted,

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